

REMARKS

Claims 1-10 are pending in the application.

Claims 1-10 are rejected.

Claims 1, 3, 5 and 8 are amended.

Claims 9-10 are cancelled, without prejudice.

No new matter is added.

With entry of this amendment, claims 1-8 remain in the case.

Applicant requests reconsideration and allowance of the claims in light of the above amendments and following remarks.

Claim Rejections – 35 § 112

Claims 1-7, and 10 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement.

Applicant respectfully traverses the rejections.

Claims 1, 3, 5 and 8 are amended to delete the limitation, "wherein a diameter of the upper opening is greater than about one third of a diameter of the lower opening." Also, claim 10 is cancelled, without prejudice. Thus, the rejections are now moot and the section 112 rejections are overcome.

Claim Rejections:– 35 § 103

Claims 1, 7, 8, and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Pat. No. 5,254,214 issued to Hijikata et al ("Hijikata") in view of U.S. Pat. No. 5,716,485 issued to Salimian et al. ("Salimian").

Claims 2 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Hijikata in view of Salimian.

Claims 3-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hijikata in view of Salimian as applied to claims 1 and 7 above, and further in view of U.S. Pat. No. 4,539,068 issued to Takagi et al ("Takagi").

Claims 5-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hijikata in view of Salimian as applied to claims 1 and 7 above, and further in view of U.S. Pat. No. 5,645,900 issued to Ong et al ("Ong").

Applicant respectfully traverses the rejections.

Claim 1 is amended to recite, "An apparatus for forming a thin film, the apparatus comprising:

a chamber having a gas inlet and a gas outlet, said chamber having an upper part with a dome configuration;

a susceptor provided in said chamber to place the wafer thereon; and

a non-mesh plasma electrode to which RF power is applied to generate a plasma within said chamber, the non-mesh plasma electrode structured to form a thin film having a uniform thickness on a wafer;

wherein said plasma electrode is of a truncated dome shape to cover said upper part, and wherein the electrode has a lower opening and an upper opening, and wherein a diameter of the upper opening is sized to form a thin film having a uniform thickness,

wherein the upper opening overlying the lower opening, the upper opening having a diameter smaller than the lower opening, the lower opening closer to the susceptor than the upper opening."

The claimed invention is directed to forming a thin film on a semiconductor substrate. In the prior art, a thin film is formed by supplying process gases, for example, SiH_4 and NH_3 into a chamber and then by making the gases into plasmas. If a RF power is weak, because the process gases normally exist in the form of radicals containing hydrogen atoms, a strong RF power needs to be applied so that hydrogen atoms contained in the process gases, (e.g., SiH , SiH_2 , SiH_3 , NH , or NH_2) can be completely decomposed to evaporate. However, with such a strong RF power and with a conventional electrode structure, it has been difficult to form a thin film having not only good thickness uniformity, but also good film quality. See page 3, lines 5-19 of the present application.

To solve these problems, in the present invention recited in claim 1, the plasma electrode is structured to form a thin film having a uniform thickness on a wafer. In particular, the plasma electrode is of a truncated dome shape ...the electrode has a lower opening and an upper opening, and wherein a diameter of the upper opening is sized to form a thin film having a uniform thickness," as recited in claim 1. See page 5, lines 7-19 of the present application.

The Examiner has argued that claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than function and thus the limitation "to deposit a thin film having a uniform thickness on a wafer" is not given a patentable weight.

To the contrary, it is well established that there is nothing inherently wrong with defining some part of an invention in functional terms. See MPEP 2173.05 (g) and cases cited therein. A functional limitation must be evaluated and considered, just like any other limitation of the claim, for what it fairly conveys to a person of ordinary skill in the pertinent

art in the context in which it is used. In the present invention, the limitation "a diameter of the upper opening is sized to form a thin film having a uniform thickness" defines the upper opening in a manner that would be clear to a person of ordinary skill in the art, thus precisely defining structural attributes.

In contrast, Hijikata or Salimian teaches mainly the plasma electrode structured for etching substrates (See, for example, abstract of Hijikata and col. 2, lines 52-62 of Salimian), while the present invention is directed to thin film formation, which is governed by different principles from the etching process. Therefore, even if Hijikata is modified by Salimian, the resulting apparatus is an etching apparatus, not a thin film forming apparatus.

Further, none of the cited references teach or disclose the above problems of the present invention nor the solution of the present application, e.g., a diameter of an upper opening sized to form a uniform thickness. None of the cited references teach or suggest the relationship between the size of the upper opening of the electrode and the uniformity of the thin film formation, as in the claimed invention. Therefore, the cited references, either alone or in combination, do not teach or suggest the above limitations of claim 1, e.g., "the non-mesh plasma electrode structured to form a thin film on a wafer"... "a diameter of the upper opening is sized to form a thin film having a uniform thickness."

Furthermore, claim 1 is amended to recite, "the electrode has a lower opening and an upper opening, ... wherein the upper opening overlying the lower opening, the upper opening having a diameter smaller than the lower opening, the lower opening closer to the susceptor than the upper opening."

On the contrary, Salimian teach the opposite arrangement, e.g., the "apex" being the lowest and a wider base overlying the apex. See col. 6, lines 42-63 of Salimian. Also, see col. 8, lines 21-29 of Salimian, which recites, "a first powered electrode adapted to support the substrate... a second electrode disposed at a distance from said first powered electrode ... an apex of said conical shape closer to said first electrode than a base of said conical shape. Thus, Salimian cannot teach or suggest, "the upper opening overlying the lower opening, the upper opening having a diameter smaller than the lower opening, the lower opening closer to the susceptor than the upper opening," as recited in amended claim 1 of the present application. If such an arrangement of Salimian is reversed to meet the limitation of the claimed invention, it would not produce the desired etch profile as shown in FIG. 20 of Salimian. Also, see col. 7, lines 42-48 of Salimian. The claimed combination cannot change the principle of operation of the primary reference or render the reference inoperable for its

intended purpose. See MPEP 2143.01. Therefore, Salimian and Hijikata cannot be combined to teach the claimed invention recited the limitation of claim 1.

Thus, the cited references, either alone or in combination, do not teach or suggest all of the limitations of claim 1. Accordingly, the rejection does not present a *prima facie* case of obviousness. Therefore, claim 1 is allowable and claim 2, which depends therefrom and recites features that are neither taught nor disclosed in the cited references, is also allowable.

For the above reasons, claims 3, 5, and 8, which recite similar limitations to claim 1, are also allowable. It is to be noted that claim 8 now additionally recites, "said upper opening has a diameter of about 70mm to 300mm." The Examiner has stated that "a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device." However, none of the cited references show such non-obvious effect of the claimed invention as illustrated in FIG. 4 and page 5, lines 20-26 of the present application.

In conclusion

For the foregoing reasons, reconsideration and allowance of claims 1-8 of the application as amended is solicited. The Examiner is encouraged to telephone the undersigned at (503) 222-3613 if it appears that an interview would be helpful in advancing the case.

Respectfully submitted,

MARGER JOHNSON & McCOLLOM, P.C.

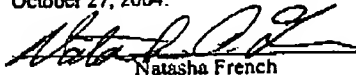


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Limited Recognition Under 37 CFR § 10.9(b)

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